# REMARKS

In his Office Action, the Examiner objected to the form of Claim 1 and rejected Claims 1, 2, and 4 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,669,650 to Moe (Moe '650) in view of U.S. Patent No. 5,721,413 to Moe (Moe '413). The Examiner rejected Claims 5-9 under 35 U.S.C. 103(a) as being unpatentable over Moe '650 in view of Moe '413, and further in view of Japanese Patent No. 03-243286 to Masskatsu et al. (Masakatsu). The Examiner rejected Claims 10-12 under 35 U.S.C. 103(a) as being unpatentable over Moe '650 in view of Moe '413, Masakatsu, and further in view of U.S. Patent No. 3,941,299 to Godfrey.

In response, Applicants have canceled Claim 1, added new Claims 14-17 to more particularly define the claimed invention, and amended Claims 2, 4-8, and 11 accordingly. No new matter has been added.

Applicants have replaced Claim 1 with new independent Claim 14, which more completely recites the steps of interconnecting the tubular members. Applicants have explicitly recited the steps of forming the first and second ends. Support in the specification can be found on page 2, line 31 to page 2a line 3 and page 3, lines 27-30 of the specification.

Further, Claim 14 more clearly states that one or more of the concave and convex shapes has a sloping configuration where the central axis of the concave or convex shapes is angled inwardly, or "toed in," toward the longitudinal axis of the tubular. Support for the sloping configuration of the concave and convex shapes can be found in Figures 1 and 2 of the drawings, which show both of the concave and the convex shapes being angled inwardly by "X" degrees. Additionally, Claim 14

more clearly states that the shapes on the respective ends of the tubulars deform due to the thermal expansion of the tubular ends during the heating step and convex shape is then pressed into the concave shape to join the first and second ends. Support for the amendment can be found on page 3, lines 1-25 of the specification.

In order to provide additional clarity, Applicants have also more fully recited that the method includes the steps of positioning the first end to be proximate to and in axial alignment with the second end, heating the ends, and pressing the shapes together to join the first and second ends. Support can be found in Figures 1 and 2 of the drawings, showing the ends being proximate to and in axial alignment (Figure 2), page 2a, lines 1-2 of the specification, and Figure 1, showing the first and second ends pressed together.

In the latest office action, the Examiner asserted that Moe '650 teaches that the heated tubular ends deform as a result of thermal expansion. Applicants respectfully disagree. While Moe '650 teaches heating the ends, the ends deform as a result of the pressing the ends together, not as a result of thermal expansion. Moe '650 states, "[t]his is done in order to more easily obtain a tri-axial stress condition in the joint area when the material, during the pressing together of the parts, flows so that these obtain the form shown in Figure 3." (See column 3, lines 16-29). Thus, Moe '650 *mechanically* deforms the ends of the tubulars to obtain the weld and does not rely on thermal expansion.

The Examiner cites Moe '413 for the proposition that one tubular end has a concave shape and the second tubular end has a convex shape. New independent Claim 14 defines over Moe '413 because Moe '413 does not show that at least one of the concave and convex shapes is "toed in" or that the central axis of each shape aligns with the other.

In contrast, the Applicants have taken advantage of the thermal expansion of the tubular ends by combining it with the "toed in" aspect of at least one of the concave and convex shapes to create a stronger weld. In addition to the normal weld strength associated with pressing the heated tubular ends together, after joining and upon cooling, the Applicants' concave and convex shapes form an interference fit that keeps the ends of the joined tubulars from separating. Moreover, Figure 2 of the drawings shows that both the convex and concave shapes may be toed in, further increasing strength of the interference fit. In contrast, the concave and convex shapes of Moe '413 cannot form an interference fit and the weld is no stronger than a conventional weld.

Claims 2, 4-9, 15, 16, and 17 are patentable at least for their dependence on Claim 14. With regard to new Claim 15, support can be found on page 3, lines 9-18 of the January '05 specification. With regard to new Claim 16, support can be found in Table 1 on page 6 of the specification. With regard to new Claim 17, support can be found in Figure 2 of the drawings, which show that both the concave and convex shapes have axes that are angled inward, of "toed-in."

The Examiner rejected Claims 10-12 as being obvious over Moe '650 in view of Moe '213, Masakatsu, and further in view of Godfrey. With regard to Claim 10, the Examiner asserts that it would have been obvious to one of skill in the art to use the flushing gas of Godfrey in the method of Moe. Applicants respectfully disagree. The Applicants teach that it is advantageous to use a reducing flushing gas. See page 2, lines 5-10 of the specification. Godfrey teaches using a nonreactive atmosphere rather than a reactive one and, therefore, teaches away from reducing the surface of the objects to be joined (Abstract, column 1, lines 65-67, column 2, lines 30-40, and

Claim 12).

The Examiner also asserts that it would have been obvious to substitute the welding process taught by the Applicants for the brazing process of Godfrey. The Applicants again respectfully disagree.

The brazing process taught by Godfrey is directed to joining two objects, preferably at least one of which is a copper alloy, in an inert atmosphere (abstract). In the brazing process, the two objects to be joined are placed into contact with one another and a brazing alloy having a melting temperature that is below the melting point of the other two objects is applied at the point of contact. The objects and the brazing alloy are then heated to a temperature above the melting point of the brazing agent but below the melting point of either of the two objects being joined. See Godfrey, column 1, lines 60-68. Thus, the brazing agent is the only material bonding the two objects together and the base objects themselves are unaffected. See column 2, lines 60-65.

Additionally, the described brazing agents, which are copper or silver alloys (column 2, lines 1-20), are highly susceptible to oxidation. This makes the brazing process completely unsuitable for the joining of tubulars, which are often subjected to high physical stresses and materials that have high salt, heavy metals, and high chemical concentrations.

In contrast, Applicants' forge welding process fuses the material from the two objects being joined and results in the weld having similar physical and chemical properties as the tubes themselves. This means the bond is much stronger and more corrosion resistant than a brazed joint.

In summary, the Applicants have revised the claims to more particularly define the claimed invention and more explicitly recite the steps of interconnecting the tubular members. The Applicants believe that the application is now in condition for allowance. The requisite fee for a

three month extension of time is being filed with this Amendment and Response. The Commissioner is hereby authorized to charge any deficiency to Deposit Account No. 503982 of Momkus McCluskey, LLC.

Respectfully submitted,

*/Steven Behnken/*
Steven Behnken
Registration No. 62,451

**CUSTOMER NO. 64770**

MOMKUS McCLUSKEY, LLC
1001 Warrenville Road, Suite 500
Lisle, Illinois 60532-4306
Telephone: (630) 434-0400, ext. 163
Fax: (630) 434 0444
Email: sbehnken@momlaw.com

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